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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

TRINH, THANH TRUC

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/673,367	Applicant(s) TANAKA ET'AL.	
	Examiner Thanh-Truc Trinh	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 and 15-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 15-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>1/22/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Applicant's election with traverse of claims 8-10 in the reply filed on 05/03/2007 is acknowledged. The traversal is on the ground(s) that claims 8-10 are amended to depend on claims 1, 3, 15 and 16. This is not found persuasive because claims 8-10 are drawn to method, while claims 1, 3, 15 and 16 are drawn to product. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by different methods such as electroplating.

Since Applicant has elected group I drawn to product, claims 8-14 are withdrawn from consideration. Claims 1-7 and newly added claims 15-18 are examined. (See below).

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 112

1. Claims 3-7, 15, 17-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably

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convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

As amended, claim 3 at line 4 lines 4-5 recite limitation "Bi content of greater than 5 mass % to 89 mass % and the solder has a melting point of 193-195°C". There is no support for this limitation in the specification originally filed. Instead the disclosure indicates a composition having melting point of 225°C at most corresponds to 5 to 88% Bi, and another composition having melting point of 195°C at most correspond to 27-79 mass % Bi. There is no portion of the disclosure describing the combination of Bi content of greater than 5 mass % to 89 mass % Bi and melting point in the range of 193-195°C.

Also as added, claim 15 lines 3-4 recite limitation "Bi content of greater than 5 mass % to 89 mass % and an Ag content of 0.1 to 1.3 mass %". There is no support for this combination in the specification originally filed. Instead the disclosure gives several compositions at certain melting points. For example, a composition having a melting point of 225°C at most corresponds to 5-88 mass % Bi when the amount of Ag contained is 0.1 mass % and to 3-89 mass % Bi when the amount of Ag contained is 1.3 mass %. There is nothing in disclosure describing the Bi content of greater than 5 mass % to 89 mass % and an Ag content in the range of 0.1 –1.3 mass %.

The same grounds apply to dependent claims 4-7 and 17-8.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara et al (US Patent 4737197) in view of Hwa et al (PGPub 20030007886).

Nagahara et al disclose a solar cell having an electrode, or contact 4, coated with solder 5. (See Figure 1 or col. 2 lines 15-18).

With respect to claim 4, Nagahara et al. describe firing silver paste to form the electrode. (See col. 3 lines 23-25)

Nagahara et al. do not teach using lead-free solder, nor do they teach using Sn-Ag based solder and including phosphorus in the solder.

With respect to claim 1, Hwa et al teach including phosphorus in Sn-Ag based lead-free solder. (See paragraphs [0007]-[0008])

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With respect to claim 2, Hwa et al describe the mass percent of phosphorus in the lead-free solder is up to 0.5%, which is well within the claimed range of 0.00001 to 0.5. (See paragraph [0008])

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify solder coated electrode of Nagahara et al. by using lead-free solder as taught by Hwa et al., because it would provide a lead-free solder that is suitable for use as a direct replacement for conventional lead-containing. (See paragraph [0095]).

4. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara et al (US Patent 4737197) in view of Hwa et al (PGPub 20030007886) and further in view of Yoshida et al. (US Patent 4256513).

Nagahara et al and Hwa et al. et al disclose a solar cell having solder coated electrode as described in claim 4 of section 3.

Neither Nagahara et al nor Hwa et al. et al describe average grain size of 11 μm at most and mass % of powdery glass included in the silver paste, nor do they teach the average thickness of the silver paste of at least 15 μm .

Regarding claim 5, Yoshida et al teach using glass grain size of smaller than 1 μm , which is well within the claimed range of 11 μm at most. (See col. 6 lines 33-36)

Regarding claim 6, Yoshida et al teach using 1-10% by weight of glass (See table 1), and preferably 7-9% by weight of glass, which is well within the claimed range of 2.8-10.0 mass %. (See col. 11 lines 13-14).

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Regarding claim 7, Yoshida et al teach that electrode thickness can be larger than 100 μm , which is well within the claimed range of at least 15 μm . (See col. 14 lines 1-5)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the silver electrode of Nagahara et al and Hwa et al. et al by applying silver paste with glass powdery grain size of smaller than 1 μm , glass powdery mass percent of 7-9%, electrode thickness of greater than 100 μm as taught by Yoshida et al, because it would improve the photoelectric conversion device by giving excellent output performance. (See col. 18 lines 34-37 and lines 55-59)

5. Claims 2-4 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara et al (US Patent 4737197) in view of Kruppa (DE 10117404).

Nagahara et al disclose a solar cell having an electrode, or contact 4, coated with solder 5. (See Figure 1 or col. 2 lines 15-18).

With respect to claim 4, Nagahara et al. describe firing silver paste to form the electrode. (See col. 3 lines 23-25)

Nagahara et al. do not teach using lead-free solder, nor do they teach including phosphorus in the Sn-Bi-Ag based solder with a Bi content of greater than 5 mass % to 89 mass % and the solder has a melting point of 193-195°C.

With respect to claim 2, Kruppa teaches the phosphorus in the solder is 0-0.01%. (See translated Detail Description).

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With respect to claim 3, Kruppa teaches including phosphorus in the Sn-Bi-Ag solder with Bi content of 30-60 mass %. (See translated Detailed Description). Since Kruppa teaches the compositional limitation of the solder of the instant claims, therefore it is the Examiner's position that the solder of Kruppa is having melting point of 193-195°C.

With respect to claim 17 and 18, Kruppa teaches including phosphorus in the Sn-Bi-Ag solder with Bi content of 30-60 mass %, and preferably 50-60 mass %, which is well within the range of 27-79 mass % or 35-60 mass% of the instant claims.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the solder coated electrode of Nagahara et al. by using Sn-Bi-Ag based solder with phosphorus as taught by Kruppa because it would give a solder with low melting point. (See section titled "Novelty")

6. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahara et al (US Patent 4737197) in view of Kruppa (DE 10117404).

Regarding claim 15, Nagahara et al disclose a solar cell having an electrode, or contact 4, coated with solder 5. (See Figure 1 or col. 2 lines 15-18).

Nagahara et al. do not teach using lead-free solder, nor do they teach including phosphorus in the Sn-Bi-Ag based solder with a Bi content of greater than 5 mass % to 89 mass % and a Ag content of 0.1 to 1.3 mass %.

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Kruppa teaches including phosphorus in a lead-free solder, wherein the Bi content is from 30-60 mass % (preferably 50-60 mass %), and the Ag content is 0-4%. (See Translated Detailed Description).

It would have been obvious to one having ordinary skill at the time the invention was made to modify the solder of Nagahara with a Sn-Bi-Ag solder including phosphorus as taught by Kruppa, because it would give a solder with low melting point. (See section titled "Novelty").

Regarding claim 16, Nagahara et al disclose a solar cell having an electrode, or contact 4, coated with solder 5. (See Figure 1 or col. 2 lines 15-18).

Nagahara et al. do not teach using lead-free solder, nor do they teach including phosphorus in the Sn-Bi-Ag based solder with a Bi content of 27 to 79 mass %.

Kruppa teaches including phosphorus in a lead-free solder, wherein the Bi content is from 30-60 mass % (preferably 50-60 mass %). (See section titled "Detailed Description")

It would have been obvious to one having ordinary skill at the time the invention was made to modify the solder of Nagahara with a Sn-Bi-Ag solder including phosphorus and Bi content of 30-60 mass % as taught by Kruppa, because it would give a solder with low melting point. (See section titled "Novelty").

Response to Arguments

Applicant's arguments with respect to claims 1-7 and 15-18 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that there was no suggestion in the cited art to make the claimed solar cell. The Examiner respectfully disagrees. Nagahara et al. teach a solar cell electrode is coated with a solder, and both Hwa et al. and Kruppa teach the composition of a solder used in circuit board, or a solder that is used in electrical conducting and wiring. Therefore they are functionally equivalent and properly combined. The Examiner also points out that Nagahara et al. do suggest using the solder in solar cell.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh-Truc Trinh whose telephone number is 571-272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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